

REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. Specifically, Applicants have canceled claim 1 without prejudice or disclaimer, and have substituted therefor new claim 10. New claim 10 recites the subject matter set forth in previously considered claim 1, and additionally further defines the polycondensing in terms of the procedure used therefor, that is, that the polycondensing is conducted by the steps (1) and (2) as recited in claim 10. Note, for example, the paragraph bridging pages 5 and 6 of Applicants' Specification. In light of canceling of claim 1, and substitution therefor of new claim 10, the dependencies of claims 2-9 have been amended.

In addition to new claim 10, Applicants are adding new claims 11 and 12 to the application. Claims 11 and 12, each dependent on claim 10, respectively recites the relative viscosity of the polyamide obtained in the step (1), and recites the temperature at which the solid polymerizing is performed, consistent with descriptions in the paragraph bridging pages 5 and 6 of Applicants' Specification.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed October 4, 2005, that is, the teachings of the U.S. patents to Matlack, et al., No. 5,028,462, and to Harada, et al., No. 4,908,272, under the provisions of 35 USC §102 and 35 USC §103.

In particular, it is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such a gas-barrier multi-layer structure as in the present claims, including wherein the gas-barrier layer A of this multi-layer structure includes a crystallizable polyamide resin, which has a minimum half crystallization time of 40-2000s in a measuring

temperature range from a glass transition point thereof to less than a melting point thereof when measured by isothermal crystallization according to depolarization photometry, and wherein such crystallizable polyamide resin is one produced by the steps (1) and (2) of (1) melt-polymerizing the diamine component with the dicarboxylic acid component to produce polyamide; and (2) solid-phase polymerizing the polyamide obtained in step (1), with the relative viscosity of the polyamide resin thus obtained in step (2) being in a range of 2.3 – 4.2. See claim 10.

As will be shown infra, and particularly as shown by the experimental evidence enclosed herewith, discussed infra, the crystallizable polyamide resin produced by the steps (1) and (2) as in claim 10 is different from, and provides unexpectedly better results than, compared with a polyamide resin produced by melt-polymerizing only; and it is respectfully submitted, that, accordingly, the crystallizable polyamide resin as recited in the present claims, produced by the recited processing, must be considered in terms of the recited processing. See in re Luck, 177 USPQ 523, 525 (CCPA 1973).

In addition, it is respectfully submitted that the references as applied by the Examiner would have neither taught nor would have suggested such a gas-barrier multi-layer structure as in the present claims, having the features as discussed previously in connection with claim 10, additionally, including wherein the relative viscosity of the polyamide obtained in the melt-polymerization is in a range of 1.6 – 2.28 (see claim 11); and/or the temperature of the solid-phase polymerizing, as in claim 12; and/or the oxygen transmission co-efficient of the polyamide resin as in claim 2; and/or melting point (see claim 3) or glass transition point (see claim 4) of the polyamide resin; and/or relative thickness of the gas-barrier layer, of the overall thickness of the multi-layer structure, as in claim 7; and/or characteristics of the thermoplastic resin for the thermoplastic resin layer B as in claim 5, or wherein the

thermoplastic resin of this thermoplastic resin layer B is a polyolefin (see claim 6); and/or wherein the layers A and B are laminated to an intervening adhesive resin layer (see claim 8); and/or wherein the structure is made into a form of a multi-layer container (see claim 9).

The present invention is directed to a multi-layer structure having excellent gas-barrier properties, and also having fabricability, less malodor and discoloration and other excellent properties such as transparency and heat resistance.

Polyamides produced by the polycondensation of xylylenediamine and an aliphatic dicarboxylic acid such as, for example, adipic acid have been extensively used as gas-barrier packaging materials such as films and bottles. Such polyamides have been used to form multi-layer structure composed, in addition to the polyamide, of a thermoplastic resin.

Gas-barrier multi-layer containers having a polyolefin layer and a polyamide layer have been disclosed, as described on pages 2 and 3 of Applicants' Specification. However, problems arise in utilizing a higher-melting crystallizable polyamide together with a, e.g., polyolefin co-forming the multi-layer structure. That is, when a polyolefin and a higher-melting crystallizable polyamide are co-extruded into a multi-layer structure, the polyolefin resin is subject to a severe heat history; and, in particular, in the production of a multi-layer structure containing polypropylene discoloration, malodor generation, etc., due to heat degradation of the polypropylene resin unfavorably occur.

As can be seen in the foregoing, it is still desired to develop a multi-layer structure comprising, e.g., a layer of polyamide produced from m-xylylenediamine and adipic acid, with good fabricability and capable of providing containers that are fully satisfactory in transparency, heat resistance, appearance and gas-barrier properties.

Against this background, Applicants have found, as a result of extensive studies, that a multi-layer structure containing a polyamide resin having a specific monomer composition and a specific crystallization rate is excellent in fabricability, and has properties as desired.

In addition, Applicants have further found that in obtaining the polyamide by melt polycondensation such polyamide has a relatively low molecular weight, usually has a relative viscosity of 1.6 – 2.28; and that this low viscosity in turn causes drawbacks, for example, drawdown or gradual thickening of the polyamide layer towards the edges of sheets occurring when formed into a multi-layer shaped article such as a film, sheet and bottles, and the thickness of the polyamide layer becomes uneven in the production of a bottle preform, thereby making the production of multi-layer shaped articles difficult. Applicants' have further found that these drawbacks can be eliminated by further subjecting the melt-polymerization polyamide having a relatively low molecular weight to solid-phase polymerization. Note, for example, the paragraph bridging pages 5 and 6 of Applicants' Specification.

As to the unexpectedly better results achieved according to the present invention, wherein the polyamide has been formed by steps including, inter alia, solid-phase polymerization, attention is respectfully directed to the enclosed Declaration Under 37 CFR §1.132 of T. Kanda, one of the named inventors of the above-identified application. Attention is, in particular, directed to Polyamides 4 and 5 described on pages 3 and 4 of the enclosed Declaration, which correspond to polyamides in Example 3 in Matlack, et al. It is respectfully submitted that these Polyamides 4 and 5 constitute the closest prior art in connection with the presently claimed subject matter. Attention is also directed to Table 6 on page 10 of the enclosed Declaration, and the discussion of the results therein as set forth on page 11. As can be seen, the polyamide resin according to the present invention contains

superior effects in both formability of multi-layer sheets and formability of multi-layer containers, as compared with polyamide resins according to Matlack, et al., prepared by a polycondensation method without a solid-phase polymerization.

It is respectfully submitted that the results of the enclosed Declaration show that the polyamide according to the present invention, prepared by processing techniques recited in the present claims, is a different polyamide than the polyamide resin of Matlack, et al., and provides unexpectedly better results as compared therewith. Clearly, the enclosed evidence supports patentability of the presently claimed subject matter.

Matlack, et al. discloses multi-layer bottles comprising inner and outer layers of a thermoplastic resin and at least one intermediate layer of a specific polyamide composition. Note column 1, lines 11-18. The polyamide composition is described most generally from column 4, line 39 to column 5, line 8. See also, column 5, lines 22-36, for a further description of the polyamide composition. Note also column 7, lines 1-6, and column 8, lines 54-59, for a further description of the polyamide composition, including techniques for production thereof. For example, this patent discloses in columns 7 and 8 that the polyamide composition can be prepared directly by condensation of acid and diamine components in suitable proportions or by blending of homopolymer and/or copolymer compositions to achieve the appropriate compositions; or by copolymerizing, e.g., isophthalic acid, teraphthalic acid, adipic acid, metaxylylenediamine and hexamethylenediamine in a preferred molar ratio. See also, for example, Example 3 in columns 12 and 13 of this patent. Melt polymerization is used in forming the polyamide.

It is respectfully submitted that this reference does not disclose, nor would have suggested, the polyamide resin as recited in the present claims, which includes the processing utilized for forming such resin, and advantages thereof; and/or the

other features of the present invention as discussed previously, and advantages thereof.

Harada, et al. discloses a gas-barrier multi-layered structure which includes at least one layer of a specified copolyamide composed of a specific dicarboxylic acid component and specific diamine component, and at least one layer of a thermoplastic resin other than the copolyamide. Note, column 1, lines 4-11; see also column 2, lines 20-33. Note further, column 2, lines 43-45 and 49-58. Note also column 3, lines 16-18 and 31-35. See further, column 5, lines 11-14.

Even assuming, arguendo, that the teachings of Harada, et al. were properly combinable with the teachings of Matlack, et al., such combined teachings would have neither disclosed nor would have suggested the presently claimed gas-barrier multi-layer structure including the gas-barrier layer A comprising the crystallizable polyamide resin, having the recited minimum half crystallization time and formed by processing including the melt-polymerizing and solid-phase polymerizing as recited in the present claims, and advantages thereof; and/or the other features of the present invention as in the other claims and as discussed previously, and advantages thereof.

The contentions by the Examiner with respect to the teachings of Matlack, et al., as set forth in Item 2 on pages 2 and 3 of the Office Action mailed October 4, 2005, are noted. It is noted that the Examiner states that Matlack, et al. does not specify the minimum half crystallization time, but the Examiner contends that the reference discloses the same chemical composition and thus the polyamide of the reference "would inherently have the same physical properties, such as crystallization and melting point". Such contention by the Examiner is respectfully traversed. As seen, for example, in the enclosed Declaration, processing utilized in forming the polyamide has an effect on properties thereof; and it is respectfully

submitted that Matlack, et al., would have neither taught nor would have suggested the structure of the present claims comprising the gas-barrier layer A including the crystallizable polyamide resin, having the minimum half crystallization time and being a resin produced by processing as recited in the present claims.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

If the Examiner believes that there are any matters which can be resolved by way of either a personal or telephone interview, the Examiner is invited to contact Applicants' undersigned attorney at the number indicated below.

Applicants request any shortage or excess in fees in connection with the filing of this paper, including extension of time fees, and for which no other form of payment is offered, be charged or credited to Deposit Account No. 01-2135 (Case: 396.43206X00).

Respectfully submitted,
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